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ABSTRACT

The importance of metacognition to the process of critical reading is discussed in this report. Specifically, the report covers two areas of research: (1) reading for meaning, which involves the metacognitive activity of comprehension monitoring, and (2) reading for remembering, which includes identifying important ideas, testing one's mastery of material, developing effective study strategies, and allocating study time appropriately. The final section of the report discusses the potential application of the research for developing instructional routines to help alleviate some of the more disabling consequences of inadequate knowledge and control of effective reading strategies. (Author/FL)

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CENTER FOR THE STUDY OF READING

Technical Report No. 188

METACOGNITIVE SKILLS AND READING

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Abstract

The importance of metacognition to the process of critical reading is discussed. Two broad areas of research are covered: reading for meaning (comprehension) and reading for remembering (studying). Reading for meaning involves the metacognitive activity of comprehension monitoring, which entails keeping track of the success with which one's comprehension is proceeding, ensuring that the process continues smoothly, and taking remedial action if necesary. The metacognitive aspects of reading for remembering include identifying important ideas, testing one's mastery of material, developing effective study strategies, and allocating study time appropriately. In the first part of the paper, we consider the research concerned with comprehension monitoring, and in the second we discuss some selective research on studying. In the final section we consider the potential application of the research described for developing instructional routines to help alleviate some of the more disabling consequences of inadequate knowledge and control of effective reading strategies.

Metacognitive Skills and Reading

What is Metacognition?

In this paper we discuss the relationship between metacognitive skills and effective reading. One of the most influential trends in developmental cognitive psychology has been a growing interest in the child's metacognitive status, i.e., the knowledge and control he has over his own thinking and learning activities, including reading. As the concept of metacognition is somewhat fuzzy, it seems appropriate to begin by explaining how the term has been used, the phenomena to which it refers, and its particular relevance to reading.

The term has been used to refer to two somewhat separate phenomena and we would like to make this separation explicit here. Flavell (1978) defined metacognition as "knowledge that takes as its object or regulates any aspect of any cognitive endeavor." Two (not necessarily independent) clusters of activities are included in that statement: knowledge about cognition and regulation of cognition.

The first cluster is concerned with a person's knowledge about his own cognitive resources and the compatibility between himself as a learner and the learning situation. Prototypical of this category are questionnaire studies and confrontation experiments, the main purpose of which is to find out how much a child knows about certain pertinent features of thinking, including himself as a thinker. The focus is on measuring the relatively stable information that the child has concerning the cognitive processes involved in any academic task. This information is stable in that one would

expect that a child who knows pertinent facts (e.g., that organized material is easier to learn than disorganized material, that passages containing familiar words and concepts are easier to read than those composed of unfamiliar ones) would continue to know these facts if interrogated properly. This information is also statable, in that the child is able to reflect on the processes and discuss them with others.

The ability to reflect on one's own cognitive processes, to be aware of one's own activities while reading, solving problems, etc. is a late-developing skill with important implications for the child's effectiveness as an active, planful learner. If the child is aware of what is needed to perform effectively, then it is possible for him to take steps to meet the demands of a learning situation more adequately. If, however, the child is not aware of his own limitations as a learner or the complexity of the task at hand, then he can hardly be expected to take preventive actions in order to anticipate or recover from problems.

The second cluster of activities studied under the heading metacognition consists of the self-regulatory mechanisms used by an active learner during an ongoing attempt to solve problems. These indices of metacognition include checking the outcome of any attempt to solve the problem, planning one's next move, monitoring the effectiveness of any attempted action, testing, revising, and evaluating one's strategies for learning. These are not necessarily stable skills in the sense that although they are more often used by older children and adults, they are not always used by them, and quite young children may monitor their activities

on a simple problem (Brown, 1978). Learners of any age are more likely to take active control of their own cognitive endeavors when they are faced with tasks of intermediate difficulty (since if the task is too easy, they need not bother; if the task is too hard, they give up). Effective learning requires an active monitoring of one's own cognitive activities. Failure to monitor can lead to serious reading problems, as we shall document.

A third concern of psychologists interested in metacognition is the development and use of compensatory strategies. Given that a learner has some awareness of his own cognitive processes, and is monitoring his progress sufficiently well to detect a problem, what type of remedial activity will he introduce to overcome that problem? Strategies vary depending on the goal of the activity; for example, reading for meaning demands different skills than reading for remembering (studying). What types of strategies are available to a learner and with what efficiency can they be orchestrated are important developmental questions with obvious implications for the study of reading.

Since effective readers must have some awareness and control of the cognitive activities they engage in as they read, most characterizations of reading include skills and activities that involve metacognition. Some of the metacognitive skills involved in reading are: (a) clarifying the purposes of reading, that is, understanding both the explicit and implicit task demands; (b) identifying the important aspects of a message, (c) focusing attention on the major content rather than trivia; (d) monitoring ongoing activities to determine whether comprehension is

occurring; (e) engaging in self-questioning to determine whether goals are being achieved; and (f) taking corrective action when failures in comprehension are detected (Brown, in press-a).

Although the current focus on such planning and monitoring activities falls within the framework of research on metacognition, reading researchers and educators will recognize that the issues are not new. Researchers since the turn of the century (e.g., Dewey, 1910; Huey, 1908/1968; Thorndike, 1917) have been aware that reading involves the planning, checking, and evaluating activities now regarded as metacognitive skills. Moreover, numerous studies have attempted to determine differences between good and poor readers in the strategies that are crucial to effective reading (Golinkoff, 1975-76; Ryan, in press). Thus, although the term metacognition may be new, the knowledge and skills to which it refers have long been recognized. Therefore, in this chapter we will consider research both explicitly and implicitly concerned with problems of metacognition in reading.

Plan of the Paper

In this paper we will deal with two broad areas of research: reading for meaning (comprehension) and reading for remembering (studying). Reading for meaning involves the metacognitive activity of comprehension monitoring, which entails keeping track of the success with which one's comprehension is proceeding, ensuring that the process continues smoothly, and taking remedial action if necessary (Baker, 1979a). The metacognitive aspects of reading for remembering include identifying important ideas, testing one's

mastery of material, developing effective study strategies, and allocating study time appropriately.

In the next two sections we will consider the research on reading for meaning and then some selected research on studying. Under both broad headings we will concentrate on the three main types of metacognitive skills: awareness, monitoring, and the deployment of compensatory strategies. In the final section we will consider the potential application of this research for developing instructional routines to help alleviate some of the more disabling consequences of inadequate knowledge and control of reading activities.

Reading for Meaning

Reading for meaning is essentially an attempt to comprehend, and any attempt to comprehend must involve comprehension monitoring. In this section we will begin by briefly considering theories of comprehension monitoring from both cognitive psychology and reading research. We will then proceed to a consideration of the existing data on children's knowledge of such activities and their ability to monitor their own comprehension both in listening and reading tasks. Finally, we will review recent research on comprehension monitoring in adults that dispels the tacit assumption that inadequate metacognition is a disease of childhood.

Experts' Theories about Comprehension Monitoring

Comprehension monitoring activities are implicitly, if not explicitly, incorporated into several recent models of comprehension (e.g., Collins,

Brown, & Larkin, in press; Goodman, 1976; Ruddell, 1976; Rumelhart, in press; Woods, in press). These theories view comprehension as an active process of hypothesis testing or schema building. Readers make hypotheses about the most plausible interpretation of the text as they are reading and test these hypotheses against the available information. As more information is acquired, hypotheses can be further refined or modified. If a reasonable set of hypotheses cannot be found, comprehension suffers. Markman (in press) specifically considers the relationship between comprehension and comprehension monitoring with respect to the reader's expectations or hypotheses about meaning. She argues that if one is able to confirm or disconfirm one's hypotheses, one can acquire knowledge about how well one is comprehending the text. Markman suggests that one need not continually ask whether or not one understands; often information about one's comprehension is a by-product of the active comprehension process itself. In some cases, all that may be necessary to detect failures to comprehend is the active attempt to understand.

Recent theories of reading incorporate similar comprehension strategies. Ruddell's (1976) model involves evaluating information adequacy, data gathering, hypothesis building, organizing and synthesizing data, and hypothesis testing. According to Goodman (1976), readers must test their hypotheses against the "screens" of meaning and grammar by frequently asking themselves if what they are reading makes sense. The reader must "monitor his choices so he can recognize his errors and gather more cues when needed" (p. 483).

This characterization of comprehension as an active constructive process is certainly not new. Thorndike (1917) suggested that comprehension problems arise if the reader "is not treating the ideas produced by the reading as provisional [so that he can] inspect and welcome them or reject them as they appear." Moreover, he argued that, "The vice of the poor reader is to say the words to himself without actively making judgments concerning what they reveal." In his research, Thorndike found that many sixth graders did not spontaneously test their understanding; although they often felt they understood, they in fact did not. Such behavior reflects poor comprehension monitoring.

A number of researchers have speculated about the conditions under which comprehension failures occur (Brown, in press-a; Eller, 1967; Flavell, in press; Markman, in press; Rumelhart, in press; Woods, in press). There seem to be three main types of comprehension failures: (a) The appropriate schemata are not available; that is, the reader does not have enough knowledge about the topic to impose an interpretation upon the text. (b) The appropriate schemata are available, but the author has not provided enough clues to suggest them; that is, the author is at fault in not conveying his or her ideas clearly enough. (c) The reader finds a consistent interpretation of the text, but not the one the author intended; that is, the reader "understands" the text, but misunderstands the author. Readers who understand incorrectly have much the same feelings as readers who understand correctly. Hence, they can hardly be expected to take remedial action when comprehension fails, since they don't realize that

comprehension has in fact failed. Readers who have failed to understand because they were unable to construct any coherent interpretation are more likely to initiate attempts to clarify their understanding.

If we broaden the conception of comprehension to include critical reading, a fourth cause of comprehension failure can be identified: The reader interprets the material in a manner desired by the author, rather than considering an alternative interpretation, and "thus is deluded to some degree" (Eller, 1967). Critical reading involves not only imposing sense on the material in the way the author intended, but going beyond the information given and critically evaluating it. Thus, good comprehension also depends on an awareness that authors write for a variety of purposes and that they may employ propaganda techniques to sway readers to a particular point of view.

Although mature readers typically engage in comprehension monitoring, it is not often or even usually a conscious experience. For example, Brown (in press-a) distinguishes between an automatic and debugging state. The skilled reader is one who can be characterized as operating with a lazy processor. All his top-down and bottom-up skills (Rumelhart, in press) are so fluent that he can proceed merrily on automatic pilot, until a triggering event alerts him to a comprehension failure. While the process is flowing smoothly, his construction of meaning is very rapid, but when a comprehension failure is detected, he must slow down and allot extra processing to the problem area. He must employ debugging devices and strategies which take time and effort. T. Anderson (in press) has also

suggested that mature readers need not devote constant attention to evaluating their understanding. He postulated the existence of an "automated monitoring mechanism" which "renders the clicks of comprehension and clunks of comprehension failure." Similarly, Flavell (in press) argues that there are probably few conscious metacognitive experiences when comprehension is proceeding smoothly; such experiences are more likely to become conscious when progress is blocked and some obstacle to comprehension arises.

One commonly experienced triggering event is the realization that an expectation we have been entertaining about the text is not to be confirmed. Another triggering situation is when we encounter unfamiliar concepts too often for us to remain tolerant of our ignorance. Whatever the exact nature of the triggering event, we react to it by slowing down our rate of processing, allocating time and effort to the task of clearing up the comprehension failure. And in the process of disambiguation and clarification, we enter a deliberate, planful, strategic state that is quite distinct from the automatic pilot state, where we are not actively at work on debugging activities. The debugging activities themselves occupy the lion's portion of our limited processing capacity, and the smooth flow of reading abruptly stops.

Realizing that one has failed to understand is, of course, only a part of comprehension monitoring; one must also know what to do when comprehension failures occur. This involves a number of important strategic decisions. The first decision is whether or not remedial action is even

necessary, a decision that will depend largely on the purposes for reading (Alessi, Anderson, & Goetz, 1979). If the reader decides to take strategic action, a number of options are available. He or she may store the confusion in memory as a pending question (T. Anderson, in press), in the hope that the author will soon provide clarification. Or the reader may decide to take action immediately, which may involve rereading, jumping ahead in the text, or consulting a dictionary or knowledgeable person.

Whimbey's (1975) characterization of a good reader captures much of the essence of comprehension monitoring:

> A good reader proceeds smoothly and quickly as long as his understanding of the material is complete. But as soon as he senses that he has missed an idea, that the track has been lost, he brings smooth progress to a grinding halt. Advancing more slowly, he seeks clarification in the subsequent material, examining it for the light it can throw on the earlier trouble spot. If still dissatisfied with his grasp, he returns to the point where the difficulty began and rereads the section more carefully. He probes and analyzes phrases and sentences for their exact meaning; he tries to visualize abstruse descriptions; and through a series of approximations, deductions, and corrections he translates scientific and technical terms into concrete examples. (p. 91)

The preceding description of comprehension monitoring has focused on what theorists believe are essential skills and strategies of mature,

competent readers. It is assumed that poor readers are deficient in these skills and strategies. Whimbey (1975) compares the poor reader's performance to that of a novice biology student looking through a microscope for the first time, unable to make sense of what he sees. Both are characterized by a lack of attention to relevant dimensions and a lack of task-appropriate strategies. Similar differences have been observed between novice and expert chess players (Chi, 1978) and X-ray technicians (Thomas, 1968). Novice technicians fail to scan as exhaustively as necessary and fail to focus on the most informative areas, a problem of immaturity analogous to poor readers' failure to concentrate on main ideas and failure to reread critical sections. The fact that novices exhibit similar patterns of behavior, regardless of age, demonstrates the crucial role of experience and expertise in cognitive monitoring (Brown & DeLoache, 1978).

Successful comprehension monitoring may also depend on individual differences other than reading ability. Some students are less willing to admit, even to themselves, that they have failed to understand, and they frequently will not ask questions for fear of appearing stupid (Holt, 1964). Personality characteristics such as dogmatism and closed-mindedness may also impair comprehension monitoring by leading readers to jump to conclusions without careful analysis (Kemp, 1967; Sullivan, 1978). Similarly, differences in cognitive style may influence comprehension monitoring. Field-independent students are more likely than field-dependent students to adopt an active hypothesis-testing approach to many learning situations (Goodenough, 1976). Similar differences between reflective and impulsive

children have far-reaching effects on their school performance in a variety of domains, including reading (Kagan, Moss, & Sigel, 1963).

Children's Theories about Comprehension Monitoring

Most theories of reading for meaning acknowledge the crucial role of comprehension monitoring activities. Experts agree that such activities are essential for adequate understanding of texts. Here we consider what children know about reading for meaning. One simple way of assessing what children know is to ask them. A primary source of evidence that young children and poor readers have metacognitive deficits in reading comes from interview investigations of children's conceptions of the purposes of reading. In general, younger and poorer readers have little awareness that they must attempt to make sense of text; they focus on reading as a decoding process rather than as a meaning-getting process (Canney & Winograd, 1979; Clay, 1973; Denny & Weintraub, 1963, 1966; Johns & Ellis, 1976; Myers & Paris, 1978; Reid, 1966). Two recent studies have provided representative findings of this type of research and will be discussed below.

Canney and Winograd (1979) studied children's conceptions of reading by using an experimental manipulation as well as an interview technique. Children in grades 2, 4, 6, and 8 were presented with passages that were either intact or disrupted at four levels of severity: (a) correct syntax, but some semantically inappropriate words; (b) semantic and syntactic violations, but some semblance to connected discourse; (c) strings of random words; and (d) strings of random letters. The children were asked if each type of passage could be read and why; they were also given a questionnaire

probing their conceptions of reading. Children in second and fourth grades, and even sixth graders identified as poor comprehenders, focused on the decoding aspect of reading. In contrast, the better readers in sixth grade and all eighth graders knew that meaning-getting was the primary goal of reading. Moreover, poorer comprehenders often reported that all but the passage containing letter strings could be read. Since these children believed that reading is being able to say the words correctly, a passage of unrelated words seemed just as readable as an intact passage.

Thus, younger and poorer readers seem to be unaware that they must expend additional cognitive effort to make sense of the words they have decoded. They seem to lack "sensitivity" (Flavell & Wellman, 1977) to the demands of reading for meaning. Myers & Paris (1978) recently examined another aspect of children's metacognitive knowledge about reading, their understanding of how different variables affect performance. Children in second and sixth grades were asked a series of interview questions assessing their knowledge about person, task, and strategy variables (Flavell & Wellman, 1977) involved in reading. Many differences were apparent in children's knowledge about comprehension monitoring. For example, older readers understood that the purpose of skimming was to pick out the informative words, while younger readers said they would skim by reading the easy words. These different skimming strategies reflect conceptions of reading as meaning-getting and as word-decoding, respectively. Kobasigawa, Ransom, and Holland (Note 1) also found that it was not until eighth grade that the majority of children could describe "how to skim," although from

fourth grade on, approximately half the children could do so. The older children in the Myers and Paris study also had more awareness of appropriate strategies for coping with words or sentences they didn't understand. They were more likely than younger children to say they would use a dictionary, ask someone for help, or reread a paragraph to try to figure out the meaning from context.

Although the interview studies provide tantalizing glimpses of the child's understanding, or lack of understanding, of the actual demands of reading for meaning, there are serious problems associated with self-report techniques (Brown, 1978; in press-a). Briefly, even adults are less able to introspect about their cognitive knowledge than one would like (Nisbett & Wilson, 1977; but cf. White, 1980), and the problems of eye-witness testimony are no less acute when asking the witness to testify about the workings of his mind than about the activities of the world around him. For this reason we advise that conclusions concerning what a child knows and can do when reading should not rely exclusively on self-report techniques of the kind favored in interview studies, where the child is asked to imagine a reading situation and to predict how best to perform in it. Convergent evidence concerning metacognitive skills must come from observations of children actually undertaking the reading tasks in question. In the next section we will consider the research on children's comprehension monitoring during ongoing attempts to understand messages.

Comprehension Monitoring While Listening

A great deal of developmental research has focused on the young child's difficulty in comprehending a message when listening. If children have difficulty monitoring their comprehension while listening, it is not surprising that they are similarly plagued when attempting the more difficult task of reading. Because of the obvious parallel, we will review briefly the aural comprehension data before considering analogous reading situations.

Some of the earliest evidence of poor comprehension monitoring was provided by Piaget (1926). When young children listened to a story or a technical description about how an object such as a faucet functioned, they often indicated that they had understood the message when in fact they had not. This was revealed both by later questioning and the fact that the message quality itself was poor, having been conveyed by another youngster with poor understanding. Moreover, the listeners seldom sought clarification or asked additional questions of the speaker. Modern experiments on referential communication skills have corroborated Piaget's observations (see Asher, 1979, and Patterson & Kister, in press, for reviews of this literature). Young elementary school children frequently indicate that they have understood a message even when it was ambiguous or incomplete (Ironsmith & Whitehurst, 1978; Karabenick & Miller, 1978). They often fail to question the speaker or seek additional information when their understanding is poor (Cosgrove & Patterson, 1977).

In a recent experiment, Flavell, Speer, Green, and August (Note 2) examined the development of comprehension monitoring and knowledge about communication. Kindergarten and second-grade children listened to taped instructions for constructing block buildings, given by a young girl serving as a confederate. The children were told to make a building exactly like the instructor's using blocks that were available to them. They were shown how to use the tape recorder and were encouraged to stop and replay the instructions as often as they wished. Flavell and his associates used a ploy popular in examinations of comprehension monitoring: They manipulated the instructions so that their comprehensibility was adversely affected. Thus, some of the instructions contained ambiguities, unfamiliar words, insufficient information, or unattainable goals. Failure to notice such deliberately introduced inadequacies or confusions was taken as evidence of ineffective comprehension monitoring.

The children were videotaped as they attempted to carry out the instructions, and the videotapes were analyzed for nonverbal signs of problem detection, e.g., looking puzzled or replaying the tape. The children were later asked if they had succeeded in making a building exactly like the instructor's and whether they thought the instructor did a good job in conveying the instructions. As expected, the older children were more likely to notice the inadequacies in the messages than the younger children. Even though both kindergarteners and second graders gave nonverbal signs of puzzlement during the task, the kindergarteners were less likely to report later that some of the messages were inadequate. This finding further

attests to the lack of reliability of young children's verbal reports (Brown, 1978, and in press-a; Winograd & Johnston, 1980).

Markman (1977, 1979) has also examined children's ability to analyze oral messages for completeness and consistency. In her first study (Markman, 1977), children in first and third grades listened to simple instructions on how to play a game or perform a magic trick; crucial information was omitted. For example, the instructions for the card game were as follows:

> We each put our cards in a pile. We both turn over the top card in our pile. We look at the cards to see who has the special card. Then we turn over the next card in our pile to see who has the special card this time. In the end the person with the most cards wins the game.

The instructions were incomplete, because, among other things, there was no mention of what the "special card" might be. Third graders realized the instructions were incomplete much more readily than did the younger children. It was often not until the first graders actually tried to carry out the instructions that they realized that they did not understand. It seems clear that the first graders did not actively evaluate whether the instructions made sense as they were listening.

These results suggest that first graders often fail to monitor their comprehension, even though it is comparatively easy to test one's understanding of instructions by evaluating whether a goal can be attained. Monitoring comprehension of text is more difficult because the criteria for

successful comprehension are less explicit and readers must select their own standards for evaluation. Thus, the effectiveness of comprehension monitoring may depend not only on age but also on the nature of the materials. This suggestion receives some support in Markman's second (1979) study. Children in third, fifth, and sixth grades listened to short essays containing inconsistent information and then answered questions designed to assess awareness of the inconsistencies. Following is an example from a passage about fish:

> Fish must have light in order to see. There is absolutely no light at the bottom of the ocean. It is pitch black down there. When it is that dark the fish cannot see anything. They cannot even see colors. Some fish that live at the bottom of the ocean can see the color of their food; that is how they know what to eat.

The obvious inconsistency here is that fish cannot see colors at the bottom of the ocean, yet some can see the color of their food. Children in all grades tested were equally unlikely to report the inconsistencies. Although third graders in the card game study did report failures to understand instructions, children of the same age and older failed to report confusions in the essays. However, when specifically warned about the inconsistencies, a greater proportion of children, primarily sixth graders, reported them. This indicates that comprehension monitoring is easier when one has some idea of what to look for, that is, when the criteria for evaluation are more explicit.

The experiments reviewed in this section show that young school children are poor at analyzing oral messages for clarity, completeness, and consistency. These shortcomings may be due to children's failures to monitor their understanding effectively. Nevertheless, failures to report message inadequacies may occasionally be due to factors other than poor comprehension monitoring (Baker, 1979a, 1979b; Brown, in press-a; Winograd & Johnston, 1980). Perhaps the children believed they understood the message (i.e., they evaluated their understanding and found it adequate), but their interpretation did not match the author's interpretation. It is also possible that the children made inferences to resolve the potential sources of confusion, and were unable, for reasons of verbal ability or memory, to convey this when questioned. The children may also have been unwilling to point out problems in the messages or to say they didn't understand, despite efforts to make them feel comfortable doing so.

One additional point to keep in mind is that these studies evaluated comprehension monitoring in a listening task rather than a reading task. Despite many similarities, there are some important differences between listening and reading that may contribute to differences in comprehension monitoring in the two situations (Kleiman & Schallert, 1978; Rubin, in press). In oral communication situations listeners have the opportunity to interact with the message source (the speaker): They can ask questions, request clarification, look puzzled, and so on. Readers are unable to interact directly with their message source (the author) and so must depend on their own resources to make sense of the message. In this respect, a

listener has an advantage over a reader in clarifying comprehension difficulties, but in other respects, a reader is at an advantage. Due to the permanence of text, readers can adjust the rate of input depending on the success of their understanding. They can also reread previous sections of text and look ahead in search of clarification (Kleiman & Schallert, 1978). However, in order to take advantage of these sampling options, the reader needs to know that they are available and must also know how to use them efficiently. It is precisely in these skills that differences exist between good and poor comprehenders (e.g., Golinkoff, 1975-76; Ryan, in press; Smith, 1977; Strang & Rogers, 1965). In the following section, we will consider children's comprehension monitoring during reading by examining performance on a variety of representative reading tasks.

Comprehension Monitoring While Reading

Ratings of felt understanding. One way of assessing feelings of understanding is to ask people to rate their certainty that they have answered a comprehension question correctly or incorrectly. Readers are considered good comprehension monitors if they indicate that they are sure their answers are correct when in fact they are, or if they indicate that their answers are wrong when the answers are indeed incorrect. On the other hand, readers are considered poor comprehension monitors if there is a mismatch between their confidence ratings and the correctness of their answers. A study by Forrest and Waller (Note 3) investigated children's skills at evaluating their understanding using this confidence rating technique. The subjects were third and sixth graders, identified by test

scores as good, average, or poor readers. Each child read two different stories for each of four different purposes: (a) for fun, (b) to make up a title, (c) to find one specific piece of information as quickly as possible (skim), and (d) to study. After reading each story, the children were given a comprehension test and then rated their confidence in their answers.

The result of primary interest was that older children and those who were better readers were more successful at evaluating their performance on the comprehension test than the younger and poorer readers. Not surprisingly, the older and better readers scored higher on the comprehension tests and were more likely to adjust their reading strategies in response to the task instructions. In addition, a posttest questionnaire showed that the younger and poorer readers had less knowledge about comprehension monitoring and fix-up strategies, a result which replicated the findings of Myers and Paris (1978).

Although the Forrest and Waller study showed differences as a function of age and reading ability, the confidence rating approach to studying comprehension monitoring has certain limitations. One problem is that young children frequently respond to questions affirmatively, regardless of the truth of their assertions (see Brown & Lawton, 1977). Thus, the third graders may have felt their answers were wrong, yet responded that they were sure they were right simply because of a positive response bias. This bias would lead to lower comprehension monitoring scores relative to the sixth graders, who used more mature criteria for making their decisions. A second limitation of the technique is that it tests one's ability to judge the

correctness of an answer given after reading, rather than assessing one's feelings of understanding or misunderstanding during reading.

Self-corrections during reading. More direct evidence of monitoring one's understanding during reading comes from self-corrections of errors. Several studies of oral reading have revealed differences between good and poor readers both in the types of errors made and in the likelihood of spontaneous corrections. Clay (1973) found that beginning readers in the upper half of their class spontaneously corrected 33% of their errors, while beginners in the lower half corrected only 5% of their errors. Weber (1970) reported that good and poor readers in the first grade did not differ in the extent to which they corrected errors that were grammatically acceptable to the sentence context, but that good readers were twice as likely to correct errors that were grammatically inappropriate. In a comparison of average and above-average sixth-grade readers, Kavale and Schreiner (1979) found that the average readers were more likely to make meaning-distorting errors and were less likely to correct those errors that did occur. Similar patterns have even been observed with adults (Fairbanks, 1937; Swanson, 1937). The results of these studies suggest that good readers, even those as young as first grade, monitor their comprehension as they are reading; if they make an error that does not fit in with the previous context, they will stop and correct themselves. If the error is semantically acceptable, however, good readers may not correct it since their comprehension still seems to be proceeding smoothly.

One explanation for these differences between good and poor readers is that poor readers have difficulty decoding the words and so are unable to benefit from the contextual information that signals meaning distortions. However, recent experiments by Isakson and Miller (1976, Note 4) have shown that when good and poor readers were matched on the ability to decode words in isolation, good readers still made fewer errors when reading in context. In addition, good fourth-grade readers were more likely to detect semantic and syntactic anomalies introduced into the sentences than were poor readers. When the good readers encountered an anomalous word, they frequently tried to "fix up" the resulting comprehension difficulty by substituting a more sensible word. Poor readers, on the other hand, read the anomalous words without apparent awareness of the problem. Thus, good readers, in addition to keeping track of the success or failure with which their comprehension was proceeding, also took measures to deal with any difficulties which did arise.

Comprehension monitoring measured by the cloze technique. A recent study by DiVesta, Hayward, and Orlando (1979) explored the development of comprehension monitoring strategies by using a cloze technique. In a cloze test, people are presented with passages containing word deletions and they are asked to supply the missing words. Because good readers make better use of contextual information and redundancy than poor readers, they are typically more successful on such tasks (Neville & Pugh, 1976-77). DiVesta et al. constructed passages such that in order to fill in the missing words, a subject either needed to read ahead for relevant contextual information or

could rely on previous context. They predicted that whereas better readers would perform equally well on both types of tests, younger and poorer readers would perform less well on the cloze task requiring use of subsequent context. This prediction was based on a hypothesized developmental shift from believing that the printed word is inviolate to realizing that writers may be at fault. Less mature readers, who attribute comprehension failures to their own shortcomings, should deal with such failures by rereading previously read text. More mature readers, on the other hand, should adopt a strategy of searching subsequent text for clarification.

High school students of high and low reading ability served as subjects in one study, and good and poor readers from sixth, seventh, and eighth grades participated in a second. As expected, the older and better readers performed equally well on both cloze tasks, while the younger and poorer readers performed more poorly when they were required to make use of subsequent context. The authors concluded that younger and poorer readers made less efficient use of the strategy of searching subsequent text for clarification of information. Mastery of this strategy may be an important development in the ability to monitor one's comprehension, but it is not clear that searching subsequent text if a failure to comprehend arises is necessarily a better or more mature strategy than rereading previously read sections of text. While it may be true that the rereading strategy develops earlier, there are times when it is a more appropriate and efficient strategy (Alessi, Anderson, & Goetz, 1979). A good comprehension monitor

will select whatever strategy is most appropriate to the situation at hand. In addition, because the demands of the cloze test are quite different from those of a typical reading situation, the failure to use a strategy of looking ahead may not extend to normal reading.

On-line measures of processing during reading. One of the best sources of information about processing behaviors are "on-line" measures obtained while a subject is actually reading. Such measures include eye movements, eye-voice span (EVS), and reading times. Studies have shown that good readers modify their eye movements when faced with difficult materials and adapt them appropriately when given different instructions for reading, such as reading for the general idea vs. reading to obtain a detailed understanding (I. Anderson, 1937; Levin & Cohn, 1968). Good readers also have longer eye-voice spans than poor readers, indicating they use a scan-for-meaning strategy rather than a word-by-word approach. In addition, good readers reread previous sections of text only if they are unable to understand an entire chunk of text, while poor readers, when they make regressive movements, do so within single words (Buswell, 1929). It is unfortunate that most of the studies which have obtained on-line measures of reading behavior have not assessed comprehension. Equally unfortunate is the fact that most comprehension studies have not obtained processing measures. We clearly need information of both types to attain a better understanding of the monitoring processes crucial to good comprehension (Ryan, in press).

Self-reports during reading. Although many of the observed differences between good and poor readers implicate metacognitive factors, few studies have examined the metacognitive experiences of their subjects during reading. The interview studies, which questioned children about the strategies they would use in hypothetical situations, revealed differences in knowledge about reading but did not address actual differences in reading skills. Are readers aware of using particular strategies as they read? Do they consciously modify their reading strategies in response to changes in task demands? How carefully do they evaluate their ongoing comprehension processes? Some researchers have attempted to answer such questions by asking readers to comment on their thoughts and behaviors while they are engaged in reading.

Introspective reports collected from adults have provided evidence that mature readers do possess some awareness and control of their comprehension processes (Collins, Brown, & Larkin, in press; Olson, Duffy & Mack, Note 5). For example, Collins et al. presented short, difficult-to-understand passages to adults and asked them to describe how they had processed the text. Analysis of the protocols revealed the complex processes involved in attempting to construct an interpretation of a passage, such as evaluating it for plausibility, completeness, and interconnectedness.

Several self-report studies have been conducted in an effort to identify differences in strategy use between good and poor readers in high school (Olshavsky, 1976-77, 1978; Smith, 1977; Strang & Rogers, 1965). Olshavsky (1976-77) presented students with stories to read, clause by

clause, and instructed them to talk about what happened in the story and about what they were doing and thinking as they read. Good and poor readers were quite similar in their attempts to monitor comprehension; when they failed to understand words or clauses, they used contextual cues, inferential reasoning, and rereading as strategies for resolving comprehension difficulties. In a second study, Olshavsky (1978) used the same procedure but varied the difficulty of the passages. Contrary to her predictions, strategy use decreased rather than increased with passage difficulty, for both good and poor readers. Olshavsky attributed her unexpected results to the fact that students simply gave up trying to understand the difficult passages.

Though strategy differences between good and poor readers were minimal in Olshavsky's studies, other investigators have found interesting differences due to reading ability. Strang and Rogers (1965) observed that good readers often tried to describe their process or method of reading a short story, while poor readers seemed almost completely unaware of the processes of reading. In addition, poor readers were less likely to take remedial measures when they encountered ideas and words they did not understand. Similarly, Smith (1977) reported that good readers adjusted their reading behaviors depending on whether they were reading for details or general impressions, while poor readers used the same behaviors for both purposes. In addition, the poor readers were less able to report the procedures they used. Interestingly, Smith found that neither good nor poor readers remembered being taught how to read for different purposes; it seems this is a skill that good readers develop on their own.

Finally, to strike a positive note, it is not always the case that poor readers are found deficient in metacognitive awareness. Ngadu (1977) obtained retrospective reports over a four-month period from high school sophomores enrolled in remedial reading classes. Over time, these poor readers came to use many of the strategies characteristic of good readers, and they often knew which behaviors were effective and which were ineffective in helping them comprehend. Variables that promote and foster the development of such awareness in poor readers deserve special attention.

Comprehension Monitoring in Mature Readers

The research discussed thus far has been concerned with the comprehension monitoring limitations of young children and older children who are poor readers. Underlying this research is the tacit assumption that competent readers always monitor their comprehension effectively. But do they? Given that students tend not to receive formal instruction in evaluating and regulating their understanding, perhaps there is room for improvement even among college students. Two recent studies by Baker and her colleagues have shown that this is fact the case (Baker, 1979b; Baker, Anderson, Standiford, & Radin, Note 6). In both studies, confusions were introduced into expository passages to pinpoint segments that should cause comprehension difficulties, and students were asked to report their confusions after reading. Additional evidence of comprehension monitoring was obtained by collecting retrospective reports and recall protocols (Baker, 1979b) and by recording on-line reading behaviors (Baker et al., Note 6). (See T. Anderson, 1979, for a discussion of the pilot phases of this research.)

In the first study (Baker, 1979b), college students were instructed to read six expository passages carefully in preparation for subsequent "discussion" questions. Each passage contained one of three types of confusions (inappropriate logical connectives, ambiguous referents, and inconsistent information), but subjects were not informed of their existence before reading. After subjects answered discussion questions calling for recall of the deficient sections of text, they were informed that the paragraphs did, indeed, contain confusions and were asked to report them, rereading the paragraphs if necessary. The students were also asked whether or not they noticed the confusions during reading, how they had interpreted them, and how the confusions affected their overall understanding of the paragraph.

The study provided several findings of interest. A surprisingly large percentage of the confusions (62%) were not detected, and students claimed to have noticed less than one quarter of the confusions during reading. Nevertheless, the recall protocols and retrospective reports made it apparent that many failures to report confusions were not due to failures to monitor comprehension but rather to the use of "fix-up" strategies for resolving comprehension problems. (See Baker, 1979b, for a detailed discussion of these strategies.) For example, students frequently made inferences to supplement the information explicitly presented in the text; they decided that some relevant information had been omitted and used their prior knowledge to bridge the gap. They also reported strategies of rereading and looking ahead in search of clarification. Some students

reported using criteria for evaluating their understanding that did not require fix-up strategies. For example, they realized there was a problem but decided it was trivial and not worth the effort of attempting resolution. Moreover, they occasionally failed to detect confusions because they had assigned alternative interpretations to the text; they felt they understood but in fact did not get the intended meaning.

These findings suggest that mature readers do engage in comprehension monitoring during reading, but we should not overinterpret data that are dependent on retrospective reports and measures of recall obtained after reading. In order to obtain more conclusive evidence of comprehension monitoring during reading, Baker et al. (Note 6) obtained on-line measures of reading behavior. Passages containing inconsistencies were presented on a computer terminal, sentence by sentence, under individual readers' control. Thus, students advanced to subsequent sentences at their own pace and were free to look back at previous sentences. The computer automatically recorded reading times on each exposure to a sentence and the pattern of movement through the text. After reading the passages, the students were asked to indicate which sentences, if any, contained inconsistencies. Half of the students were informed prior to reading that inconsistencies were present, while the remainder were told after reading.

As expected, students spent more time reading inconsistent passages than consistent passages, and they looked back at previous sentences more frequently when inconsistencies were present. Students were considerably more successful at detecting confusions in this study than in the previous

one, perhaps because inconsistencies are more salient than the other types of confusions used. Surprisingly, students who were explicitly instructed to monitor for inconsistencies during reading did not differ from uninformed readers in either reading behavior or confusion detection. Our interpretation of this finding is that under favorable conditions adults are able to monitor their comprehension effectively with or without specific instructions. In sum, these experiments have shown that, in general, college students evaluate their understanding during the actual process of reading. If they encounter a confusion, they devote extra time to studying it, and they reread previous sentences in an effort to clarify their understanding. It is these processes of self-regulation that children need to acquire in order to become effective readers.

Reading for Remembering

Reading for remembering, or studying, involves all the activities of reading for meaning and more. It is obviously helpful, if not absolutely necessary, to understand the material one is studying. Failures to comprehend materials to be remembered would result in a reliance on difficult rote remembering techniques to ensure retention of the material. While students have been known to approach a studying task via rote learning methods, and there is a very large body of data examining the processes underlying such procedures (Brown, 1975), we will restrict our attention here to attempts to study that rely on an initial effort to understand, followed by additional efforts aimed at ensuring retention of critical or important information. In order to study, the learner must take purposive

action to ensure that the material is not only comprehensible but memorable. In this section we will consider some selected evidence from the developmental literature that highlights the problems immature learners face when attempting to read for remembering.

We would like to emphasize, however, that the work focusing on metacognitive aspects of studying is but a small part of the large area of research on effective techniques for studying. Anderson and Armbruster (in press) review the literature on study techniques and the "how-to-study" programs that have been developed to teach effective study skills. Therefore, this section should be regarded as complementary to their much more extensive review. Here we will concentrate on a few selected studies that have been carried out recently, within the framework of metacognitive skills in children's studying. Interestingly, few investigators in the traditional study skills literature have been primarily concerned with what the student does <u>during</u> reading to facilitate learning from text. For example, Robinson's (1941) SQ3R technique instructs the student to engage in survey and question activities <u>before</u> reading, and to engage in recitation, reflection, and review activities <u>after</u> reading. However, what a student does while actually processing the material may be one of the most important aspects of effective study, and it is this aspect that the metacognitive research focuses upon.

In order to be an efficient studier one must engage in "study monitoring" (Locke, 1975), which is similar to comprehension monitoring.

> Studying actually requires a double or split mental focus. On the one hand, you need to be focused on the material itself (that is, on learning it). At the same time, however, you need to be constantly checking to see that you are actually performing those mental operations that produce learning. In short, you need to monitor your mental processes while studying. (Locke, 1975, p. 126)

Study monitoring involves the ability to concentrate on the main ideas, to introduce some deliberate tactic to aid learning and the concurrent ability to self-test the effectiveness of the strategy one has called into service. Adequately dispensing the available study time involves at least an appreciation of which material is important, and which material is not known sufficiently to risk a test. When faced with the common task of attempting to commit to memory a set of materials, when time limitations or other restrictions impede leisurely study, how do we plan our time for most efficient results? Such a task can involve very fine degrees of metacognitive judgment, as any student can attest. In this section we will consider recent work that focuses on various components of study activity: concentrating on main ideas, making use of logical structure in the material, self-interrogation during studying, self-testing the results of studying, and employing macrorules to ensure comprehension and retention.

Selecting and Studying Main Ideas

Children are commonly exhorted to concentrate on the main ideas when studying, but in order to be responsive to this suggestion, they must be

aware of what the main points of a passage are. This is a gradually developing skill, and although children as young as 6 can often indicate the main character and sequence of events in a simple narrative, they tend to experience difficulty isolating central issues in more complex prose (Brown & Smiley, 1977; Smiley, Oakley, Worthen, Campione, & Brown, 1977). For example, grade school children who were perfectly able to recall the main ideas of folk stories had much more difficulty rating sections of the stories in terms of their importance to the theme (Brown & Smiley, 1977; Brown, Smiley & Lawton, 1978). This finding has important implications for studying. In order to go beyond retention of just a few main points, i.e., to achieve a more complete "fleshed-out" memory of the text, one must engage in active strategies to ensure increased attention to material that will not be retained automatically. This need for active intervention is particularly pressing if the contents of lengthy texts are to be retained over some period of time, a typical school learning situation.

As children mature, they become better able to identify the essential organizing features and crucial elements of texts (Brown & Smiley, 1977; Pichert, 1979). Thanks to this foreknowledge, they should be able to make better use of extended study time. Brown and Smiley (1978) found that when given an extra period for study, children from seventh grade up improved their recall considerably for important elements of text; recall of less important details did not improve. Children below seventh grade did not show such effective use of additional study time. As a result, older students' recall protocols following study included all the essential

elements and little trivia. Younger children's recall, though still favoring important elements, had many such elements missing.

Older students benefit from increased study time as a direct result of their insights into the workings of their own memory and their ability to identify the important elements of the texts. Younger students, not so prescient, cannot be expected to allocate extra time intelligently; they do not concentrate on the important elements of text, since they do not know what they are. Evidence to support this claim came from an examination of the activities the students engaged in while studying. The young children rarely appeared to be doing anything more than rereading. The older students, however, underlined or took notes during studying. Students who spontaneously engaged in underlining or note-taking tended to use these devices to highlight the main ideas and, as a result of this selective attention, increased their recall of these central ideas on subsequent tests.

Once they have ensured that the main ideas are well understood, efficient students will take steps to fill in the details. One method of achieving this is to test oneself to determine which details one has failed to recall and then to devote extra attention to the previously missed information. Even grade school children can initiate some efforts to test their current state of memory (Masur, McIntyre, & Flavell, 1973), and mildly retarded children can also be taught to do so (Brown & Campione, 1977; Brown, Campione, & Barclay, 1979). But again, this can become a much more difficult task if the material is complex.

The ability to concentrate on information one has previously failed to recall was examined in a laboratory task analogous to the process of studying Brown & Campione, 1979; Brown, Smiley, & Lawton, 1978). Students from fifth through twelfth grade, together with college students, were asked to study prose passages until they could recall all the details in their own words. They were allowed repeated trials. The passages were divided into constituent idea units rated in terms of their importance to the theme; there were four levels of rated importance. On each trial the students were allowed to select a subset of the idea units (printed on cards) to keep with them while they attempted recall. After recall and a rest period, the entire process was repeated.

Of interest are the idea units selected as retrieval aids to enhance recall. On the first trial the majority of students at all ages selected the most important units to help them recall, and children below high school age continued to do this, even though across trials they became perfectly able to recall the most important information without aid but persistently failed to recall additional details. College students, however, modified their selection as a function of trials: On the first trial they selected predominantly important (Level 4) units for retrieval aids. On the second trial they shifted to a preference for Level 3 units, while on the third trial they preferred Level 2 units. On all three trials Level 1 units were treated appropriately as trivia. As they learned more and more of the material, college students shifted their choice of retrieval cues to reflect their estimated state of knowledge.

Older high school students showed the same basic pattern as the college students, but they were one trial behind; they did not begin to shift to less important units until the third trial. This lag could be due to slower learning; i.e., both groups shifted when they reached the same level of learning, but the younger students took an extra trial to reach that level. It could also be due to a slower selection of the effective study strategy of switching to less important units; i.e., both groups learned as much on each trial, but it took high school students longer to realize that they needed to shift cue selection. The latter appears to be the correct interpretation, for even when students were matched on the basis of degree of learning, the younger students still took longer to shift their choice of retrieval cues. Thus, the ability to select suitable retrieval cues is a late-developing skill because it requires a fine degree of sensitivity to the demands of studying. The successful user of the flexible retrieval plan illustrated in these studies (Brown, Smiley, & Lawton, 1978; Brown & Campione, 1979) must have (a) information concerning the current state of knowledge, i.e., what he knows of the text and what he does not yet know; (b) knowledge of the fine gradation of importance of various elements of texts, i.e., what is important to know and what can be disregarded; and (c) the strategic knowledge to select for retrieval cues information that he has missed previously.

Although the retrieval cue selection task is a somewhat artificial analogue to "true" studying, it does demonstrate the complexity of concentrating first on main ideas and then, via a process of self-testing,

gradually filling in the details. A process similar to this is involved in studying. In order to succeed, the student must have at least rudimentary self knowledge (i.e., myself as a memorizer), task knowledge (gist recall vs. verbatim recall), and text knowledge (importance vs. trivia, organization of text, etc.). The orchestration and coordination of these forms of knowledge demands a sophisticated learner, and it is therefore not surprising that efficient studying is a late-emerging skill.

Making Use of Logical Structure

Another important rule for effective studying is to capitalize on any inherent structure in the text. If the material is essentially meaningless to the student, he will have a great deal of difficulty retaining it. If the student can detect the logical structure of the material, he will be better able to learn from it.

Children have some difficulty detecting even gross violations of logical structure. For example, Danner (1976) constructed two short expository passages containing four topics related to an overall theme. In organized versions of the passages, each paragraph dealt with one topic, while in disorganized versions, each paragraph contained sentences about different topics. Children in grades two, four, and six listened to the taped passages, with each subject hearing an organized version of one passage and a disorganized version of the second.

The children were asked to recall the passages and then they were asked which passage was more difficult to learn and were asked to justify their answers. The younger children showed similar recall patterns to the older

children in that organized passages were better recalled than disorganized ones. However, the younger children had less awareness of the cause of the difference in difficulty. All children reported that the disorganized passages were more difficult, but only the older children could show the experimenter how the two passages differed or could actually state that one passage was "mixed up" and the other in the "correct order."

A recent series of studies by Bransford, Stein, Shelton, and Owings (1980) also shows that less able students have little awareness of the text and task characteristics that should be taken into account when studying, even though their memory is affected by the structure of the text. Bransford et al. presented fifth-grade students in the top and bottom quartiles of their classes with short stories which differed in the extent to which descriptions of characters were congruent with their behaviors. Examples of sentences from a congruent or "precise" story are, "The hungry boy ate a hamburger. The sleepy boy went to bed." In the "less precise" stories, the pairing of characters and events was reversed: "The hungry boy went to bed. The sleepy boy ate a hamburger." The students were allowed to spend as much time reading and studying the passages as they wished and were tested for memory with such questions as, "What did the hungry boy do?" The children were then asked which passage was harder to learn and were asked to justify their responses.

Children from both quartiles had better memory for the precise passages than the imprecise, indicating a facilitative effect of congruence with past experience. However, the better students were more likely to identify the

imprecise passages as more difficult and to include appropriate justifications for their answers. In addition, the better students spent more time studying the less precise passages than the precise, while the study times of the poorer students did not differ across the two passage types. These results show clear differences in the metacognitive knowledge brought to bear on the task. However, in subsequent work, Bransford et al. found that the poorer students were quite capable of evaluating whether the passages made sense when they were asked to evaluate them with respect to their own experiences. Moreover, with training, these students also showed differential study time for the two passage types. This suggests that although poor students do not spontaneously monitor their understanding and mastery of prose material, they are capable of doing so with relevant instruction.

Self-Interrogation During Studying

One way to facilitate learning from text during reading is to engage in self-interrogation. Andre and Anderson (1978-79) recently developed and tested a self-questioning study technique in which high school students were taught to locate sections of text containing important points and generate questions about them. They found that generating such questions facilitated learning better than simply reading and rereading text or making up questions without regard to important points. In addition, the training was more effective for students of lower ability, suggesting that the better students had developed effective self-questioning techniques of their own. Andre and Anderson suggest that self-questioning may be more effective than

such passive strategies as rereading because it incorporates many metacognitive components. That is, it encourages the reader to (a) set purposes for study, (b) identify and underline important segments of the material, (c) generate questions which require comprehension of the text to be correctly answered, and (d) think of possible answers to the questions. The questioning strategy leads the student to an active monitoring of the learning activity and to the engagement of strategic action.

Student-generated questions are valuable not only as an aid to studying but also as an aid to comprehension itself. Singer's (1978) conception of "active comprehension" involves reacting to a text with questions and seeking answers with subsequent reading. His preliminary work has shown that student-generated questions are more effective in promoting comprehension than teacher-generated questions even for children in elementary school. The ability to ask relevant questions of oneself during reading is, of course, crucial to comprehension monitoring and studying. Thus, training in effective question-asking may be an important first step in the development of monitoring skills. Collins, Brown, and Larkin (in press) suggest that many failures of comprehension are in fact due to a failure to ask the right questions; and a study by Nash and Torrance (1974) has shown that participation in a creative reading program designed to sensitize readers to gaps in their knowledge, such as inconsistencies and ambiguities, led to a significant improvement in the kinds of questions first graders asked about their reading material. Perhaps training in creative reading is a good technique for teaching children to monitor their comprehension as they read.

Instruction in critical reading may also be useful in fostering the evaluation skills required to monitor one's own understanding while reading and studying. However, although most elementary school curricula include units in critical reading, the instruction is often inadequate. Because instruction is typically postponed until children have become fluent readers, "the habit of indiscriminate acceptance of printed material may become so well established that later instruction in these skills would be extremely difficult" (Wolf, King, & Huck, 1968, p. 435). A second problem lies in the practice of limiting emphasis on critical reading to a specific class period, rather than attempting to promote critical reading in a variety of contexts (Goodman, 1976). As many educators have noted, all too few college students today are critical readers (Wolf, 1967), and this certainly poses a barrier to their development of an adequate repertoire of study skills.

Macrorules for Comprehension and Retention

An essential element of effective studying is the ability to estimate one's readiness to be tested. This can be a simple form of knowledge or it can involve very complex forms of evaluation. Consider a simple form that young children can engage in quite successfully. Presented with a set of pictures, grade school children were asked to continue studying them until they were sure they would remember all of them verbatim (Flavell, Friedrichs, & Hoyt, 1970). By third grade, the majority of normal children can accomplish this task, and with training, even mentally retarded children can greatly improve their performance (Brown, Campione, & Barclay, 1979).

Estimating that one can recall a list of items verbatim is a relatively simple task for those who engage in simple strategies like rehearsal or anticipation, thus providing immediate feedback that one can or cannot recall the list. It is not such a simple task when one must recall the gist of a prose passage. Although strategies of anticipation or rehearsal are still useful, selection of what to anticipate or rehearse is more difficult, and the criteria of successful retention are much less precise. The learner must gauge when he has grasped the main ideas, a much more subjective experience than estimating verbatim recall of a list of items. Encouragingly, training on the simple list learning task does improve the performance of retarded children in the more complex prose learning situation (Brown, Campione, & Barclay, 1979).

A commonly reported sophisticated method of testing one's level of comprehension and retention and, therefore, one's preparedness for a test, is to attempt to summarize the material one has been reading. Composing such a summary is a complex task and requires considerable skill. Brown and Day (Note 7) identified five basic rules that are essential to summarization, operations that are very similar to the macrorules described by van Dijk and Kintsch (1978) as basic operations involved in comprehending and remembering prose. Two of the five rules involve the deletion of unnecessary material. One should obviously delete material that is trivial, and even grade-school children are quite adept at this (Brown & Day, Note 7). One should also delete material that is redundant. A third rule of summarization is to provide a superordinate term or event for a list of

items or actions. For example, if a text contains a list such as cats, dogs, goldfish, gerbils, and parrots, one can substitute the term pets. Similarly, one can substitute a superordinate action for a list of subcomponents of that action, i.e., John went to London, for John left the house, John went to the train station, John bought a ticket, etc. The two remaining rules have to do with providing a summary of the main constituent unit of text, the paragraph: First find a topic sentence, if any, for this is the author's summary of the paragraph. If there is no topic sentence, invent your own. The five operations, then, are: (a) delete redundancy, (b) delete trivia, (c) provide superordinates, (d) select topic sentences, and (e) invent topic sentences where missing.

These operations are used freely by experts when summarizing texts (Brown & Day, Note 7), but do less sophisticated readers realize that these rules can be applied? Brown and Day examined the ability of children from grades 5, 7, 10 and college students to use the rules while summarizing. They used specially constructed texts that enabled them to predict when each rule should be applied, or at least would be applied by experts (college rhetoric teachers). Even the youngest children were able to use the two deletion rules with above 90% accuracy, showing that they understood the basic idea behind a summary: get rid of unnecessary material. On the more complex rules, however, developmental differences were apparent. Students became increasingly adept at using the superordination and topic sentence rules, with college students performing extremely well. However, the most difficult rule, invention, was almost never used by fifth graders, used on

only a third of those occasions when it would be appropriate by tenth graders, and used by college students on only half of the appropriate occasions. Junior college students (remedial studiers) performed like seventh graders, having great difficulty with the invention rule and using only the deletion rules effectively.

Brown and Day explained this developmental progression in terms of the degree of cognitive intervention needed to apply each rule. The easier deletion rules require only that the child omit information in the text, and the intermediate topic sentence rule requires only that the child identify and select the main sentence contained in a paragraph. But the more difficult invention rule requires that the child supply a synopsis in his own words, i.e., add information rather than just delete, select, or manipulate sentences already provided for him. It is these processes of invention that are the essence of good summarization, that are used with facility by experts, and that are most difficult for novice learners.

It is encouraging, however, that these rules can be taught. Day (1980) trained junior college students of varying levels of reading sophistication to apply the five rules and to check that they were using the rules appropriately. They were given various colored pencils and told to delete redundant information in red, delete trivial information in blue, write in a superordinate for any lists, underline topic sentences if provided, and write in a topic sentence if needed. Then, they were to use the remaining information to write a summary. After many examples and some practice, performance improved dramatically. For the more sophisticated students,

training in the rules alone was sufficient to bring about large improvements. For students with more severe learning problems, training in using the rules and procedures for self-management (checking, monitoring, etc.) were both necessary to effect improvement. But they did improve, dramatically.

The macrorules of summarization may also facilitate studying directly. Constructing an adequate summary for oneself serves as a check that one has both understood and remembered the material. Moreover, there is some evidence that it is easier to study from a summary than from the original text (Reder & Anderson, in press). Many college students learn to use such macrorules for themselves, but others do not. If we make it explicit that such rules exist, that such rules can be applied regularly, and that the application of such rules does improve performance, the study skills of the less able can be much improved.

Implications for Instruction

Throughout this chapter we have indicated some of the quite striking problems that children experience when reading. Awareness of these difficulties should sensitize teachers to possible lines of remediation. In this last section we will examine the types of skills that we feel should readily respond to training and those that should prove less tractable. Finally, we will discuss the emergence of self-awareness and self-regulation, which are fundamental to effective reading.

There are two general classes of problems that can impede effective reading: inefficient application of rules and strategies and impoverished background knowledge. The child may lack the necessary strategies to make reading an active learning experience, and we have given ample evidence of children's lack of strategic knowledge in this chapter. Alternatively, or in addition, the child may lack the requisite knowledge of the world to understand texts that presuppose adequate background experience. Instruction aimed at instigating strategic reading is somewhat easier to design than instruction aimed at instilling relevant knowledge, although, unfortunately, the two forms of knowledge interact in quite complex ways (Brown, in press-b).

Consider, first, instruction in rules and strategies. If adequate performance depends on the application of a set of rules, and these rules can be specified exactly, then it should be possible to design instructional routines that introduce the uninitiated to this possibility. For example, merely making children aware that they should continue studying and self-testing until ready for a test improves study performance in young children (Brown, Campione, & Barclay, 1979). Instructing students in efficient self-questioning techniques is also an effective training procedure (Andre & Anderson, 1978-79). Sensitizing young readers to the logical structure of text and the inherent meaning in certain passages again helps the less able reader (Bransford et al., 1980). The more explicit and detailed understanding one has of effective rules for reading, the more readily can those rules be trained. Brown and Day's work with summarization rules is a

case in point. Instructing students to make their summaries as brief as possible and to omit unnecessary information was not an explicit enough guide for junior college students. Exact specification of the rules that could be used to achieve this aim, however, was an extremely effective instructional routine (Day, 1980). The more we are able to specify the rules used by expert readers, the more we will be able to successfully instruct the novice.

The second major impediment to effective reading is a deficient knowledge base. If the text deals with topics unfamiliar to the reader, it will be difficult for him to understand the significance of the material, to select main points and disregard trivia. One has to understand the meaning of the material one is reading to be able to identify just what is important and what is trivial. One solution to this problem is to select texts that do deal with familiar material, but this is not always possible. And whereas the teacher may actively attempt to provide the requisite background knowledge for a particular text, she cannot always do this. The only answer is to increase the reader's store of information, and this takes time. The only prescription for training is one of general enrichment, which few schools have the resources to provide.

One strategy that can be instructed, however, is the general routine of attempting to fit what one is reading into a framework of whatever background knowledge one has. Efficient readers do this routinely (R. Anderson, 1977), and there is some evidence that young children will use background knowledge to flesh out their understanding of texts (Brown,

Smiley, Day, Townsend, & Lawton, 1977). Good teachers engage in four main activities to help children comprehend a lesson (Schallert & Kleiman, 1979). They tailor the message to the child's level of understanding; they continually focus the student's attention on the main points; they force the students to monitor comprehension by asking them questions about their degree of understanding; and, finally, they activate schemata, i.e., they help the students see how the new information is related to knowledge they already have. Instructing children to engage in these activities on their own while they read should be both possible and profitable.

This brings us back to a general theme running throughout the paper, the notion of self-awareness. An essential aim is to make the reader aware of the active nature of reading and the importance of employing problem-solving, trouble-shooting routines to enhance understanding. If the reader can be made aware of (a) basic strategies for reading and remembering, (b) simple rules of text construction, (c) differing demands of a variety of tests to which his knowledge may be put, and (d) the importance of attempting to use any background knowledge he may have, he cannot help but become a more effective reader. Such self-awareness is a prerequisite for self-regulation, the ability to monitor and check one's own cognitive activities while reading.

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